

REMARKS

The claims pending in the application are Claims 1-10 and 12-33. Claims 1-10 and 12-29 stand rejected. New Claims 30-33 have been added. Applicants have carefully considered all of the rejections but respectfully traverse, for example, see the reasons set forth below.

The Applicants have herein amended independent Claims 1 and 21 to recite a carbon molecular sieve comprising tube or rod shaped carbon structures arranged in a substantially uniform hexagonal pattern. Support for this amendment may be found, for example, at page 6, lines 19-26 of the specification. Claims 28 and 29 have been amended to make the language consistent with the amendments to Claim 1. Claim 8 has been amended to correct a grammatical error. No new matter has been added by the amendments to the claims. New Claims 30-33 have been added directed to use of the respective templates set forth in Claim 1. Support for Claims 30-33 may be found for example at page 3, lines 10-11 of the specification. No new matter is added by these claims. Claims 1-10 and 12-33 remain pending in the application. Applicant respectfully requests reconsideration and allowance of all claims.

Rejections Under § 103

The Examiner rejected Claims 1-10, 16, 18-26, and 29 under 35 U.S.C. § 103(a) as being unpatentable over Lee et al., alone or in view of Applicants' specification. The Examiner asserts that Lee teaches using a molecular sieve to create a carbon with uniform mesopores. The Examiner recognizes that Lee does not teach the claimed supports, however, the Examiner asserts that using the claimed supports in place of the MCM-48 support of Lee would be obvious to make carbon material of a desired structure and/or porosity. Furthermore, the Examiner argues that that the Applicants' specification appears to admit that the claimed supports are old and known materials. However, as discussed below, Applicants respectfully disagree that they have made any admissions.

The Examiner has also rejected Claims 12 and 13 under 35 U.S.C. § 103(a) as being unpatentable over Lee et al., alone or in view of Applicants' specification, and further in view of Lester et al. The Examiner has also rejected Claim 17 under 35 U.S.C. § 103(a) as being unpatentable over Lee et al., alone or in view of Applicants' specification, and further in view of Huckle.

The Applicants respectfully disagree with the Examiner's assertions.

The Relevant Law Regarding Obviousness

The MPEP states that:

[t]o establish a *prima facie* case of obviousness, ***three basic criteria must be met***. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest ***all*** the claim limitations.

MPEP § 2142 (emphasis added); *see also In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991).

The Primary Reference

Lee et al. discloses using aluminum implanted mesoporous MCM-48 aluminosilicate template to create a mesoporous carbon structure. The carbon mesopore structure obtained in Lee was a “regular array of 2 nm diameter holes separated by 2 nm thick carbon walls.” A transmission electron micrograph in Lee indicate that the array of holes are arranged in a repeating square pattern. X-ray diffraction results in Lee demonstrated that the resulting material had “the characteristic pattern of the AlMCM-48 template with a d-spacing value of 3.37 nm.” The pattern of MCM-48 is known to be cubic. *See e.g.*, R. Ryoo et al., “Synthesis of Highly Ordered Carbon Molecular Sieves via Template-Mediated Structural Transformation,” *J. Phys. Chem. B*, 103(37) 7743-7746 (indicating that MCM-48 is a member of the cubic *Ia3d* space group); J.C. Vartuli et al., “Effect of Surfactant/Silica Molar Ratios on the Formation of Mesoporous Molecular Sieves: Inorganic Mimicry of Surfactant Liquid-Crystal Phases and Mechanistic Implications,” *Chem. Mater.*, 6, 2317 (1994) (also indicating that MCM-48 is a member of the cubic *Ia3d* space group). (Both of the above references were previously supplied by the Applicants.) Therefore, the carbon structure created by Lee consisted of an array of holes in a square pattern.

Lee et al., Alone or in Combination with Other Cited Art, Does Not Teach or Suggest All of the Limitations of Claims 1-10 and 12-29

In contrast to Lee, the carbon structures created by the method of independent Claim 1 comprises rod or tube shaped carbon structures arranged in a substantially uniform ***hexagonal*** pattern. Similarly, the carbon structures claimed in independent Claim 21 comprise rod or tube shaped carbon structures arranged in a substantially uniform ***hexagonal*** pattern. Lee does not disclose a substantially uniform hexagonal pattern. Instead, Lee discloses a ***square*** pattern.

Neither does the "Description of the Related Art" section of Applicants' specification indicate that carbon structures having a hexagonal pattern have previously been made. Furthermore, Lester et al. and Hucke do not disclose these required claim limitations. Therefore, because none of the asserted references teach or suggest the claim limitation of carbon structures having a hexagonal pattern, Applicants respectfully submit that Claims 1-10 and 12-29 are not *prima facie* obvious over Lee et al., alone or in combination with Applicants' specification, or in view of any of the other asserted references.

The Prior Art Does Not Suggest to or Motivate One of Ordinary Skill in the Art to Use SBA-15, Aluminum SBA-15, SBA-3, or Aluminum SBA-3 in Order to Obtain the Claimed Structures

Neither Lee nor the "Description of the Related Art" section of Applicants' specification suggest that use of SBA-15, AlSBA-15, SBA-3, or AlSBA-3 will produce the hexagonal pattern claimed in the instant claims. Also, neither Lester et al. nor Hucke provides this suggestion. As discussed below, one cannot predict the resulting carbon structure from the structure of the template used. Therefore, because there is no suggestion or motivation in the prior art to use the claimed support structures to obtain the claimed hexagonal pattern, Applicants respectfully submit that Claims 1-10 and 12-20 are not *prima facie* obvious over Lee et al., alone or in combination with Applicants' specification, or in view of any of the other asserted references.

There Was no Reasonable Expectation that Use of SBA-15, AlSBA-15, SBA-3, or AlSBA-3 Would Produce the Claimed Structures

The Applicants' specification demonstrates the unpredictability of template production of carbon sieves. For example, in Example 4, the use of AlSBA-15 produced CMK-3, a carbon sieve comprising rod shaped carbon structures in a hexagonal pattern. In contrast, in Example 5, the use of AlSBA-15 produced CMK-5, a carbon sieve comprising tube shaped carbon structures in a hexagonal pattern. Similarly, in R. Ryoo, "Synthesis of Highly Ordered Carbon Molecular Sieves via Template-Mediated Structural Transformation," *J. Phys. Chem. B*, 103(37) 7743-7746, it was observed that carbon structures obtained using a MCM-48 template "was not simply a negative replica of the used silica template, but the synthesis mechanism involved the unique transformation into a new ordered array that was triggered by the removal of the silica frameworks." Thus, the state of the art at the time of filing demonstrates that the technique of using templates to create carbon structures was an unpredictable process. One would not be able

to predict from the structure of the template what carbon structure would result. Therefore, there was not a reasonable expectation that use of the claimed SBA-15, AISBA-15, SBA-3, or AISBA-3 would result in the claimed tube or rod shaped carbon structures arranged in a substantially uniform hexagonal pattern. As such, Applicants respectfully submit that Claims 1-10 and 12-20 are not *prima facie* obvious over Lee et al. alone or in combination with Applicants' specification, or in view of any of the other asserted references.

Furthermore, the Applicants note that the claimed structures produced by the claimed methods have the surprising characteristics of increased hydrogen adsorption and increased reduction catalytic activity when used as a platinum support as shown in the specification in Examples 7 and 8 (page 11, line 6 to page 12, line 22). These characteristics are not discussed in Lee et al. or the other asserted references.

Conclusion to § 103 Rejections

The Applicants respectfully submit that the pending claims are not *prima facie* obvious over the cited prior art because none of the three *prima facie* obviousness requirements are met. First, the prior art, alone or in combination, does not teach or suggest all of the claim limitations (e.g., the "substantially uniform hexagonal pattern" limitation). Second, there is no suggestion in the prior art to use the supports claimed in Claim 1. Third, there was no reasonable expectation of success that the supports claimed in Claim 1 would produce the claimed structure. Accordingly, the Applicants respectfully submit that Claims 1-10 and 12-33 are patentable over the prior art.

Rejections Under § 112

The Examiner rejected Claims 1-10 and 12-29 under 35 U.S.C. § 112, ¶ 1 as failing to comply with the written description or enablement requirements. The Examiner argued that there was no description in the specification of how to make the claimed nanotube structure. The Examiner noted that "carbon nanotubes" are made by high-energy catalytic processes such as laser ablation and arc-discharge.

The Applicants note that their use of the phrases "nano-tube" and "nano-line" were not meant to imply that the claimed structures were necessarily of the type produced in the high-energy processes referred to by the Examiner. (Applicants offer no opinion as to the similarity of their claimed structures to those produced by high-energy processes.) Rather, the Applicants

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were referring the general shape and size of the carbon structures produced, as evidenced by the electron micrographs in Figures 1 and 7. Solely to advance prosecution, the Applicants have amended the claims to refer to "rod or tube shaped carbon structures" instead of "nano-tube" and "nano-line." Applicants assert that they have provided a written description of such rod or tube shaped carbon structures. Specifically, Applicants have provided electron micrographs that irrefutably depict actual carbon material have a regular array of rod (Figure 1) or tube (Figure 7) shaped structures. Applicants have also enabled such structures by providing detailed examples indicated the procedures followed to obtain the depicted structures. Accordingly, Applicants respectfully submit that they have met the written description and enablement requirements.

CONCLUSION

In view of Applicants' amendments to the claims and the foregoing remarks, Applicants respectfully submit that the present application is in condition for allowance. Should the Examiner have any remaining concerns that might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number appearing below.

Respectfully submitted,

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Dated: 7/23/04

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